

## Unit 2: Systems Software (2a. Operating Systems)

Marks: /29

Answer **all** the questions.

1. Intensive Care Units in hospitals are for patients in need of round the clock monitoring and support. Computerised systems can be used to monitor patients' vital signs (temperature, heart rate, blood pressure and breathing). They can then alert medical professionals to any significant changes.

These systems usually run on an embedded, real-time, operating system.

- (i) State what is meant by the term *real-time*.

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----- [1]

- (ii) Explain why a real-time operating system would be suitable for Intensive Care Units.

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----- [2]

2(a). An operating system uses scheduling. One method of scheduling is first come, first served.

(i) Explain why the first come, first served scheduling method may **not** be efficient.

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----- [2]

(ii) Describe **one** other scheduling method.

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----- [2]

(iii) Explain why scheduling is necessary.

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----- [4]

[3]

Describe paging.

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[3]

3. Memory management in a computer for main memory can use either paging or segmentation.

(i) Explain what is meant by 'paging'.

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----- [2]

(ii) Explain what is meant by 'segmentation'.

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----- [2]

(iii) State **two** similarities between paging and segmentation.

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[2]



Question			Answer/Indicative content	Marks	Guidance
1		i	The system gives a response within a guaranteed time frame (1).	1	For 1 mark.
		ii	<ul style="list-style-type: none"> <li>• If something happens to a patient, a response must be immediate (1).</li> <li>• Other types of system may have delays in response (1).</li> <li>• This could result in a patient not receiving treatment in time (1).</li> </ul>	2	Up to 2 marks for a valid explanation that demonstrates application of knowledge and understanding to given context.
			<b>Total</b>	<b>3</b>	
2	a	i	Once a job starts it prevents other jobs from being processed A job using a slow resource (eg printer) wastes processor time	2	<b>Examiner's Comments</b>  This question seemed to baffle a lot of candidates who decided to answer a question about priorities instead. Those who answered the question properly generally managed to get one mark, there were relatively few who got full marks for this.
		ii	Round robin Time slice to each user in turn <i>Or</i> Length of job Shortest job first	2	One method only - marks in pairs Accept other examples, including Priorities Highest priority first  <b>Examiner's Comments</b>  This question was well answered by most candidates with "round robin" being the clear favourite response.
		iii	Process as many jobs as possible... ...in least possible time / quicker Ensure all jobs are processed (fairly) Maximise number of interactive users... ...with fast response times / real time Efficient use of resources / processor time	4	<b>Examiner's Comments</b>  In general, this was well answered with the whole range of expected responses from the mark scheme being used.
	b		Organise the use of (main) memory... ...by converting logical addresses to physical addresses Allows programs to share memory / allocate memory... ...& protect programs / data from each other Allows programs larger than main memory to run	3	<b>Examiner's Comments</b>  Most candidates gave correct responses to this, with the majority of those gaining two marks, the most popular answers for this were 'allocates memory' and 'protect programs from each other'.

Question			Answer/Indicative content	Marks	Guidance
	c		Partitioning memory Pages are fixed size Pages are physical divisions Used for virtual memory	3	cao  <b>Examiner's Comments</b>  A lot of candidates had problems with this question and a significant few thought that this was concerning saving to secondary memory. Very few mentioned "partitioning" and it was thought that this should be fairly standard when referring to paging.
			<b>Total</b>	<b>14</b>	
3		i	<ul style="list-style-type: none"> <li>Parts of a program divided into equal size pieces</li> <li>Uses physical divisions</li> </ul>	2	<b>Examiner's Comments</b>  This was answered as expected with most candidates getting 1 mark, a fair amount got 2.
		ii	<ul style="list-style-type: none"> <li>Parts of a program divided into unequal sizes</li> <li>Uses logical divisions</li> </ul>	2	<b>Examiner's Comments</b>  As would be expected of this question, it was the second part to the previous and the spread of marks was the same.
		iii	<ul style="list-style-type: none"> <li>Both ways of partitioning / splitting up memory</li> <li>Use virtual memory / backing store to swap parts of programs</li> <li>Allow programs larger than memory to run / insufficient memory</li> <li>Allows programs to be stored in memory noncontiguously</li> </ul>	2	<b>Virtual Memory / Backing store not enough on its own.</b>  <b>Examiner's Comments</b>  Most candidates were quite unspecific in their responses to this part of the question, this was aimed at higher grade candidates and it did define the differences between an average response and a good one.
			<b>Total</b>	<b>6</b>	

Question			Answer/Indicative content	Marks	Guidance
4			<ul style="list-style-type: none"> <li>– Complete the current FDE Cycle</li> <li>– Check the priority of the incoming interrupt.</li> <li>– If its of a higher priority than the current task.</li> <li>– Contents of registers stored in memory..</li> <li>– ... in a stack.</li> <li>– The relevant interrupt service routine is loaded ...</li> <li>– ..by loading the relevant value into the program counter.</li> <li>– When the ISR is complete the previous state is popped from the stack</li> <li>– And are loaded back into the registers.</li> </ul> (1 per –, max 6)	6	
			<b>Total</b>	<b>6</b>	